

A BACKLIGHT SOURCE DEVICE WITH CIRCULAR ARC  
DIFFUSION UNITS

FIELD OF THE INVENTION

5        The present invention relates to a backlight source device, and especially to a backlight source device with circular arc diffusion units.

BACKGROUND OF THE INVENTION

10        The present invention is suitable <sup>for use the</sup> in fabrication of LCDs, backlight displays, backlight plate of slices, advertisement billboards and the other devices with <sup>a</sup> backlight source device.

15        With the improvement of technology, LCDs, backlight displays, backlight plate of slices, advertisement billboards and the other devices using <sup>a</sup> backlight source device must be used widely, <sup>and</sup> thus a backlight source device with improving <sup>ed</sup> uniform illumination is eagerly demanded.

20        A light guide plate 1 in the prior art is shown in Fig.1, which <sup>Produces</sup> ~~cause~~ a printing pattern of <sup>a</sup> light guiding plate 1 of a lateral light source 11. The pattern is formed by a plurality of trenches or convex strips, or matrix points, and other diffusion unit <sup>s</sup>, or a plurality of parallel trenches with equal spaces and depths for diffusing and reflecting light of <sup>a</sup> lateral light source.

25        The defects of the prior art backlight source device is that in printing, the <sup>e</sup> usability of the light of the front face is relative <sup>ly</sup> low.

A Since the angles of all the diffusion units can not be <sup>Changed</sup>~~changed~~ <sup>Thus</sup>  
the output direction of the diffusing light can not be controlled.

A For example, for straight parallel trenches on the light guide plate  
of a backlight source device, <sup>a</sup>non-uniform light strip will be formed.

5 The light reflected from the area near the middle of the radiating area  
of the lateral light source 11 is stronger than that farther from the  
middle, and trenches with equal space and depth can cause that the  
emitted light are <sup>to be</sup>distributed non-uniformly.

A It is difficult to control the output angle of the output light from  
10 the light guide plate of a backlight source device, especially in the two  
sides of the diffusion unit 12. In the place near the two sides of the  
diffusion units, the angle formed by the line between the lateral light  
source and the diffusion unit and the parallel lines of the diffusion  
units <sup>can not form</sup>~~cause that a vertical projection can not be formed~~ so that the  
15 angle of light output can not be well controlled.

### SUMMARY OF THE INVENTION

A Accordingly, the object of the present invention is to provide a  
backlight source device having circular arc diffusion units so that the  
20 light reflected from <sup>a</sup>lateral light source becomes more uniform.

A Another object of the present invention is to provide a backlight  
source device with circular arc diffusion units for preventing the <sup>formation of</sup>dark  
and light regions ~~are formed~~ by the backlight source.

2 A further object of the present invention is to provide a backlight  
25 source device with circular arc diffusion units, in which a simplest

design is used to control the light output angle of the backlight source device and the illumination thereof is improved greatly.

In order to attain the aforementioned objects, the backlight source device with circular arc diffusion units in the present invention  
5 includes a transparent guide plate with circular arc diffusion units on the front or rear surface thereof, each circular arc diffusion unit having a reflecting surface; a diffusion piece above the guide plate; a reflecting piece below the guide plate; and a lateral light source.

The circular arc diffusion units of the transparent guide plate are  
10 convex or concave diffusion units, and the thickness of the guide plate is decreased with the distance to the lateral light source for reducing the loss of light energy.

The circular arc diffusion units are distributed with unequal distances. The reflecting surfaces of the circular arc diffusion units  
15 have different heights which are increased with the distances to the lateral light source. The cross section of the circular arc diffusion units has a V or circular arc shape.

The projection area of the diffusion units on the guide plate may be increased with the distance to the lateral light source. The projection  
20 area of the diffusion units on the guide plate may be increased with the distance to the light lateral source, the width of the projection area is between 0.05mm ~ 1mm.

The various objects and advantages of the present invention will be more readily understood from the following detailed description  
25 when read in conjunction with the appended drawing<sup>s</sup>.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an elevation view of a prior art backlight source device.

Figs. 2 ~ 6 are the elevation view<sup>S</sup><sub>Λ</sub> for different embodiments of the backlight source device of circular arc diffusion units in the present invention.

Figs. 7 ~ ~~9~~<sup>10</sup><sub>Λ</sub> are the lateral cross sectional and schematic view<sup>S</sup><sub>Λ</sub> for different embodiments of the backlight source device of circular arc diffusion units in the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference now to Figs. 2 ~ 9, the backlight source device of the present invention mainly comprises a transparent light guide plate 2 made by plastic (Acryl, polycarbonate) or glass or other transparent materials; a diffusion piece 3 above the light guide plate 2, wherein a prism can be added above the light guide plate or the diffusion piece; a reflecting piece 4 below the light guide plate 2; and a lateral light source 5 which is preferred<sup>ably</sup><sub>Λ</sub> a linear light source.

In the present invention, at the front or rear surface of the transparent light guide plate 2, at least one surface has<sup>a plurality of</sup><sub>Λ</sub> circular arc convex diffusion units 21 (referring to Fig. 7 or 8) or concave diffusion units (referring to Fig. 9). The cross section of<sup>each</sup><sub>Λ</sub> the diffusion unit 21 may have a V shape (as shown in Fig. 7 or 8) or circular arc (as shown in Fig. 9) or other proper shape, such as hyperbolic or elliptic shapes. The<sup>reflecting</sup><sub>Λ</sub> surfaces of the circular arc diffusion units may be smooth or coarse. If the surface is a mirror surface, then the diffusion effect

will <sup>be reduced</sup> reduce.

Further, in the present invention, the aforementioned plurality of diffusion units are distributed with unequal distances (referring to Fig. 8, where  $D1 > D2 > D3$ ). Preferably, in the present invention, the heights of the diffusion units 21 are increased to the distance with the lateral light source (as shown in Figs. 7-9).

The circular arc shape of the diffusion units 21 may <sup>assume</sup> ~~distributed~~ with an inverse direction (as shown in Fig. 3, Comparative to Fig. 2) or distributed along a diagonal line (as shown in Fig. 4), and may be interlaced by two <sup>alternating</sup> ~~alternatively~~ diffusion units (as shown in Figs. 5 and 6). Other distribution <sup>S</sup> for arranging the circular arc diffusion units 21 <sup>are</sup> ~~is~~ also included within the spirit of the present invention.

The diffusion unit <sup>S</sup> 21 of the transparent guide plate 2 of the present invention can be formed by cutting, discharging, etching, ~~laser and~~ <sup>laser and</sup> other methods. The guide plate 2 can be made by injection, thermal pressing, extrusion molding, or other method.

The projection area of the diffusion units 21 on the guide plate 2 may be increased with the distance to the lateral light source, a preferred width W is 0.05mm ~ 1mm. The thickness of the guide plate 2' can be decreased with the distance to the light source for reducing the loss of light energy, <sup>as shown in Fig. 10</sup>

#### The effect of the present invention

1. By the present invention, the reflecting light strength of the reflecting surface can be increased and the power loss is reduced,

thus the average illumination of the backlight source device is increased.

2. In the present invention, the central line of the diffusion units are ~~as~~ close to the light source ~~so~~ to conveniently control the light output angle and thus to increase the illumination.

3. The dark and light regions in the backlight source device can be removed by the present invention so that the illumination of the backlight becomes more uniform.

4. The present invention is fabricated easily and <sup>there are which</sup> many ways may be used for producing the present invention.

In summary, in the present invention, circular arc diffusion units 21 are distributed on the guide plate 2 for deleting the dark and light regions of the backlight source device so that the illumination of the backlight area becomes more uniform and the illumination also increases.

Although the present invention has been described with reference to the preferred embodiments, it will be understood that the invention is not limited to the details described thereof. Various substitutions and modifications have been suggested in the foregoing description, and others will occur to those of ordinary skill in the art. Therefore, all such substitutions and modifications are intended to be embraced within the scope of the invention as defined in the appended claims.